

Hydrologic Balance and Ocean-atmosphere Coupling Unveiled by TRMM and QuikSCAT

W. Timothy Liu, Hua Hu, Wenqing Tang, and Xiaosu Xie
Jet Propulsion Laboratory, California Institute of Technology

The tropical oceans are often covered by clouds, which hide high frequency wind forcing and oceanic response from the visible and infrared sensors on operational weather satellites. The atmosphere and its clouds are almost transparent to microwave allowing the sensors on the Tropical Rain Measuring Mission (TRMM) and QuikSCAT to unveil the variation of sea surface temperature (SST), ocean surface wind vectors, rain, and water vapor over large spectra of temporal and spatial scales. The continuous and coincident data were first applied under the intense conditions of hurricanes. The high resolution of QuikSCAT wind vectors improve the computation atmospheric moisture transport, the vertical profiles of moisture sink and diabatic heating, and the fresh water flux at the surface, when compared with the products of operational weather prediction models. The improvement was validated with measurements by TRMM. On a monthly time scale and over global tropical oceans, QuikSCAT winds and TRMM integrated water vapor were used to estimate the divergence of the vertically integrated water transport in the atmosphere and compared with surface precipitation and evaporation derived from TRMM data. The coherence between SST, wind vector, and atmospheric hydrologic parameters over the Tropical Instability Waves in the eastern near-equatorial Pacific was used to validate hypothesis on ocean-atmosphere coupling. The positive feedback among, wind, atmospheric convection, ocean temperature and current to maintain the subtropical counter current in the central and western subtropical Pacific were also examined.